

~~Freewheel bearing device and freewheel pulley~~BACKGROUND OF THE INVENTION1. Field of the Invention

_____ The present invention generally relates to ~~the field of~~ freewheel bearings, in particular sprung freewheel bearings.

2. Description of the Relevant Art

_____ ~~Such Freewheel bearing devices include~~ comprise two elements that can rotate concentrically relative to one another in freewheel mode, ~~and between which there is the need to be able to~~ The two elements transmit a torque without relative movement between the two elements when the device operates in torque take-up mode.

_____ In sprung freewheel devices, a helical spring usually performs the freewheel function. The helical spring is ~~fixedly attached~~ by one of its ends to one of the two elements of the device, ~~and, in~~ In one relative direction of rotation between the two elements, the helical spring rubs without binding on a cylindrical bearing surface of the other element. When the relative movement between the two elements is reversed, the rubbing portion of the helical spring binds on the cylindrical bearing surface, ~~this~~ The helical spring may be bound ~~binding~~ being caused by the diametral expansion of the helical spring by the unwinding effect in a cylindrical bearing surface of a housing or by the winding effect on the cylindrical bearing surface of a shaft.

_____ ~~Such Freewheel devices are~~ may be used in ~~particular in~~ alternator pulleys ~~in order to prevent inhibit~~ the transmission of the acyclicalities of ~~the an~~ engine to the alternator, particularly via a belt. ~~By thus b~~ Being able to temporarily decouple ~~the an~~ alternator from ~~the an~~ engine, it prevents, for example when there is a sudden drop in engine speed, may inhibit the alternator from becoming the driver and causing a belt voltage reversal when for example there is a sudden drop in engine speed. This ~~therefore may~~ spares the transmission belt, which enables its service life to be significantly increased.

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5 ~~Reference may be made to document WO A 98/50 709 entitled "SERPENTINE~~
 ~~DRIVE SYSTEM WITH IMPROVED OVER-RUNNING ALTERNATOR DECOUPLER"~~
 ~~and or to document US A-5,598,913 entitled "ONE-WAY OVER-RUNNING CLUTCH~~
 ~~PULLEY" describe a drive system and a pulley system.~~ The bearing function is performed by
one or more antifriction bearings or rolling bearings and the freewheel function is performed
by a helical spring one end of which is interlocked with a piece connected to an inner rotating
portion and a certain number of coils of which interact with the cylindrical bore of an outer
piece in order to transmit a torque or no torque between the inner and outer pieces depending
on the relative direction of rotation between those two pieces.

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~~Such devices are satisfactory but still have certain disadvantages.~~ When the device is
freewheeling, a ~~certain~~ number of coils of the spring rub in the outer piece with a relatively
high speed equal to the differential angular speed between the two pieces, for example
between the pulley and the hub. This may lead to rapid wear of the spring and undesirable
15 failures of the device.

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SUMMARY

Herein we describe a freewheel bearing device that may ~~The invention seeks to~~ increase the service life of freewheel bearings. ~~The device may The invention seeks to~~ reduce the wear on freewheel bearings. ~~The invention proposes~~ In some embodiments, a freewheel bearing device ~~comprising~~ may include a rolling bearing and a freewheel. ~~furnished with~~ A rolling bearing may include a plurality of rolling elements and a cage. The cage may ~~to retain the rolling elements,~~ and a ~~A freewheel furnished with~~ may include a freewheel spring. Said ~~A spring comprises~~ may include a first portion end, a second end, and/or a radial central portion. A radial central portion may interacting with the cage, and a ~~A second portion end of the spring may interacting with an element, such as an outer element and/or an inner element (e.g., an outer support, a shaft, etc.); said Elements, such as an outer and/or inner element (e.g., an outer support or shaft) may be being directly or indirectly interlocked with a body on which the rolling elements run.~~

In some embodiments, ~~The~~ the sliding speed of sliding of the spring relative to the cage or to said an element (e.g., an inner or outer element, such as an outer support or shaft) is ~~may be limited to substantially approximately half the rotation speed of the bearing. Consequently there is Limiting the sliding speed of the spring may a considerable reduction reduce in the wear of the spring and of the piece on which said the spring rubs contacts when it is not transmitting torque. In a relative first direction of rotation, the spring is may slide sliding and the freewheel is said to may be disengaged. In the opposite second direction of rotation, the spring is may be engaged and the freewheel is said to may be engaged. A torque may then be transmitted between the outer and inner elements of the bearing.~~

For the purposes of this application, ~~By directly interlocked refers to it is meant that said when an outer or inner element is either of one piece with said a body; or in contact with and/or attached coupled to to said the body. For the purposes of this application, and indirectly interlocked means refers to when an outer or inner that said element is attached coupled to said a body by means of one or more interposed pieces.~~

In one embodiment of the invention, ~~said a spring comprises may include an end or radial central portion a portion interlocked in rotation with the cage. The A spring may be in frictional contact with the outer and/or inner element. Said A spring may comprise include~~

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coils ~~that may interact~~ interacting with a cylindrical bearing surface of said ~~the outer or inner~~ element.

5 ~~_____ In another certain embodiments of the invention, said a spring comprises may include~~
~~an end portion~~ interlocked in rotation with said ~~an outer or inner element (e.g., an outer~~
~~support or shaft)~~. The ~~A~~ spring may be in frictional contact with the cage. Said ~~A~~ spring may
~~comprise include~~ coils ~~that may interact~~ interacting with a cylindrical bearing surface of the
cage.

10 In one embodiment of the invention, ~~the a freewheel comprises includes~~ a single
spring. ~~In another certain embodiments of the invention, the freewheel comprises may~~
~~include~~ two springs. ~~For example, one spring may be~~ mounted between the cage and the
outer element ~~(e.g., outer support)~~ and the other ~~spring may be~~ mounted between the cage and
the inner element ~~(e.g., shaft)~~.

15 ~~_____ In one some embodiments of the invention, the antifriction bearing comprises may~~
~~include~~ an outer ~~face groove~~ and an inner ~~face groove~~. ~~The r~~Rolling elements are ~~then may be~~
~~positioned~~ disposed between the outer and inner ~~face grooves~~. ~~In an embodiment, At least~~
one of the ~~face grooves~~ may ~~comprise include~~ an axial extension capable of interacting with
20 the spring. The ~~An~~ axial extension may be provided with ~~include~~ a bearing surface. ~~In an~~
~~embodiment, the bearing surface may capable of rubbing against or make contact with the~~
~~spring. or be provided with a bearing surface to which~~ One end of the ~~a~~ spring ~~may be~~
~~coupled to the bearing surface. is attached.~~ Advantageously, the cage ~~comprises may include~~
an axial extension in contact with the first portion of the spring.

25 ~~_____ A spring of a freewheel may be various shapes. In one embodiment of the invention,~~
~~the a spring is may be~~ helical. ~~In one embodiment of the invention, the A spring has may~~
~~include a rectangular section. The A spring may thus be~~ radially compact. ~~A spring and a~~
~~body may be a single unit.~~

30 ~~Said element may be made as a single unit with said body.~~

~~_____ In some embodiments, The invention also proposes a pulley comprising may include~~
a freewheel bearing device and a pulley body interlocked with an outer element of the

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bearing. The freewheel bearing ~~comprises~~ may include an antifriction bearing and a
freewheel with a spring. ~~furnished with a~~ An antifriction bearing may include a plurality of
rolling elements and a cage, which may ~~to~~ retain the rolling elements, ~~and a freewheel~~
~~furnished with a spring.~~ ~~The~~ In an embodiment, a spring comprises ~~may include~~ a first
5 ~~portion~~ end, a second end, and/or a radial central portion. A radial central portion may
interacting with the cage and a second portion ~~a first and/or second end may interacting with~~
an outer and/or an inner element (e.g., outer support and/or shaft). ~~said~~ Outer and/or inner
elements ~~being~~ may be interlocked with a body on which the rolling elements run.

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BRIEF DESCRIPTION OF THE DRAWINGS

Features and advantages of the methods and apparatus of the present invention will be more fully appreciated by reference to the following detailed description of presently preferred but nonetheless illustrative embodiments in accordance with the present invention when taken in conjunction with the accompanying drawings in which:

FIG.1 depicts an embodiment of a freewheel bearing;

FIG. 2 depicts a cross-sectional view of an embodiment of a freewheel bearing;

FIG. 3 depicts an embodiment of outer and inner coils of a spring;

FIG. 4 depicts an embodiment of a freewheel bearing;

FIG. 5 depicts an embodiment of a freewheel bearing in a pulley;

FIG. 6 depicts an embodiment of a freewheel bearing device with an inner spring;

FIG. 7 depicts an embodiment of a freewheel bearing device with an outer spring;

FIG. 8 depicts an embodiment of a freewheel bearing;

FIG. 9 depicts an embodiment of a freewheel bearing;

FIG. 10 depicts an embodiment of a freewheel integrated in an antifriction bearing.

While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof are shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that the drawings and detailed description thereto are not intended to limit the invention to the particular form disclosed, but on the contrary, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the present invention as defined by the appended claims.

DETAILED DESCRIPTION OF EMBODIMENTS

____ As can be seen in ~~figures depicted in FIGS. 1 to 3,~~ a freewheel bearing 1 ~~comprises~~ may include an antifriction rolling bearing 2 and a freewheel 3. A freewheel 3 may be positioned ~~mounted~~ between an inner element (e.g., a shaft) 4 with an axisymmetric cylindrical outer surface and an outer element (e.g., an outer support) 5 having a cylindrical bore 6. In an embodiment, a freewheel 3 may be mounted between a shaft 4 and an outer support 5.

____ The antifriction rolling bearing 2 ~~comprises~~ may include an outer ~~race~~ groove 7, an inner ~~race~~ groove 8, a row of rolling elements 9, and a cage 10. A cage may ~~to retain the~~ rolling elements 9. ~~The~~ An outer race groove 7 has an may include an outer surface 7a positioned ~~mounted, for example fitted, into~~ in a the cylindrical bore 6 of the ~~an~~ outer support 5. An outer groove 7 may include a rolling bearing raceway channel 7b formed on its bore; and/or two opposing radial transverse surfaces 7c and 7d. The inner ~~race~~ groove 8 ~~has~~ may include a bore 8a ~~mounted, for example fitted, onto~~ positioned on the ~~an~~ outer surface of the a shaft 4. A bore 8a may be coupled on an outer surface of a shaft 4. An inner groove 8 may include a rolling bearing ~~raceway~~ channel 8b formed on its outer surface; and two opposing radial transverse surfaces 8c and 8d. ~~The~~ Rolling elements 9 may be, ~~here balls,~~ Rolling elements 9 may be positioned ~~are disposed~~ between the rolling bearing ~~raceway~~ channels 7b and 8b. The

____ In some embodiments, a cage 10 ~~comprises~~ may include receptacles evenly distributed in the circumferential direction in which the rolling elements 9 are ~~mounted~~ positioned. A cage 10 may include portions 11 between the receptacles and a continuous circular portion 12 on one side of the rolling elements 9 radially between the racegrooves 7 and 8. ~~The~~ A cage 10 is made of may be made of molded synthetic material, ~~for example of~~ such as, but not limited to, polyamide reinforced with glass fiber.

____ In an embodiment, a ~~The~~ cage 10 also ~~comprises~~ may include an axial extension 13 which ~~extends~~ ing beyond the radial plane as defined by the radial transverse surfaces 7c and 8c of the ~~race~~ grooves 7 and 8. ~~The~~ An axial extension 13 is of may be generally circular shape and has An axial extension 13 may include a cylindrical outer surface 13a of ~~with a greater diameter than that of a diameter of a~~ the bore of the outer ~~race~~ groove 7, and An axial

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extension 13 may include a cylindrical bore 13b with a smaller or lesser diameter than that of the diameter of the an outer surface of the inner racegroove 8. An
The axial length of the an axial extension 13 may be similar to the axial length is close to that of the a rolling bearing 2.
In an embodiment, a The cage 10 may be is a made as a single unit.

In some embodiments, In addition to the axial extension 13 of the cage 10, the a freewheel 3 comprises may include a spring 14 of a substantially helical general shape. The A spring 14 comprises may include one a first end 15 formed of several coils. A spring 14 may include a first end 15 formed of three coils. , here three, In an embodiment, a first end 15 of a spring may in contact with the a cylindrical bore 6 of the outer support 5, A second another end 16 of a spring may include formed of several coils. A second end 16 of a spring may include 3 coils. , here three, A second end 16 of a spring may in contact with the an outer surface of the shaft 4, and A spring may include a radial central portion 17. A radial center portion may passing through a radial notch formed in the extension 13 or sunk into the an axial extension 13, for example by overmolding. The A radial central portion 17 of the a spring 14 is thus may be interlocked in rotation with the an extension 13 and the a cage 10.

The In some embodiments, a freewheel bearing device may operates by the take-up of torque; when the relative movement of the outer support 5 relative to the shaft 4 occurs in the direction of the arrow indicated in figure 2, for example such as when the shaft 4 is immobile and when the outer support 5 is driven in the direction of the arrow. Specifically, the A cage 10 of the rolling bearing may rotateing at an angular speed equal to approximately half the difference of the angular speeds of the outer race 7 and inner racegrooves 8, if the an outer racegroove 7 of the rolling bearing has a relative movement moves relative to the inner racegroove 8 in the direction of the arrow, the cage 10 may rotateing more slowly than the outer racegroove 7, and the result is that the outer coils of the spring 14 which are coupled is connected to the cage 10 by its radial portion 17, may have a tendency, by friction on the cylindrical bore 6 of the outer support 5, to tighten in the latter. Simultaneously, the inner second end 16 of the spring 14, driven by the cage 10 may rolls up and tightens on the shaft 4. The spring 14 may thus transmits the torque between the outer support 5 and the shaft 4.

In some embodiments, if the a radial load on the rolling elements 9 is sufficient and the torque to be transmitted is relatively weak, the torque may be transmitted between the outer first end 15 of the spring 14 and the shaft 4 via the cage 10 and the rolling element 9

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before the inner coils of the end 16 are retightened on the shaft 4. ~~In this case, t~~The inner coils of the end 16 ~~will~~ may intervene to transmit the torque if the ~~latter torque~~ increases above a certain value and causes the rolling elements 9 to slide in their rolling bearing racewaychannel 8b. Naturally, ~~In an embodiment a~~ the stiffness of the spring 14 ~~can be~~ chosen may be selected such that the torque is not transmitted by the rolling elements 9.

_____ If the direction of ~~the~~ relative movement is reversed between the outer support 5 and the shaft 4, the inner coils of the second end 16 of the spring 14 may loosen and, ~~thereby~~ allowing a relative angular movement with friction between the spring 14 and the shaft 4. The outer coils of the first end 15 of the spring 14 may also loosen, ~~thereby~~ and allowing a relative angular movement with friction between the spring 14 and the cylindrical bore 6 of the outer support 5. The device then may operates in freewheel mode.

_____ Numerous variations ~~variants~~ and applications of the device may be envisagedenvisioned. ~~FigureFIG.~~ 4 shows ~~a variant in which the reference numbers of similar elements are retaineddepicts~~ an embodiment of a freewheel bearing. The freewheel 3 ~~comprises~~ may include two independent springs, ~~one~~ an inner spring 19 and ~~another~~ an outer spring 20. ~~The~~ An inner spring 19 ~~is disposed~~ may be positioned between the bore 13b of the an axial extension 13 of the cage 10 and ~~the~~ an outer cylindrical surface of the shaft 4. An inner spring 19 may include ~~with a plurality of coils.~~ In an embodiment an inner spring 19 may include three coils, here three, Coils of an inner spring 19 may in contact with the a bore of the axial extension 13, and one An end 21 of the inner spring 19 may be angularly interlocked with the shaft 4. ~~The~~ An outer spring 20 ~~comprises~~ may include a plurality of coils. In an embodiment, an outer spring 20 may include three coils, here three, Coils of an outer spring 20 may in contact with the an outer cylindrical surface 13a of the an axial extension 13 of the cage 10, and one An end 22 of an outer spring 20 may be angularly attached ~~coupled to in the~~ a bore 6 of the outer support 5, ~~for~~ For example, an end 22 of an outer spring 20 may be coupled to a bore 6 by means of a notch 23 formed in said the bore 6 and into which the an end 22 of the spring 20 protrudes.

_____ In ~~one~~ a first relative direction of rotation between the outer support 5 and the shaft 4, the coils of the springs 19 and 20 ~~sub~~ may contact on the an axial extension 13 of the cage 10 and ~~thus may~~ allow a rotation without a transmission of significant torque. In ~~the other a~~ second relative direction of rotation, the springs 19 and 20 may tighten on ~~the~~ an axial

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extension 13 of the cage 10 and may transmit a torque while ~~making angularly interlocking in one direction~~ the an outer support 5 ~~angularly interlocked in one direction~~ with the shaft 4.

~~In the embodiment illustrated in~~ As depicted in FIG. ~~figure~~ 5, the freewheel bearing device 1 ~~is mounted~~ may be coupled to in a pulley. The outer support 5 ~~may~~ which then forms the pulley body. ~~The outer support 5 may include~~ has an outer surface 24 in the form of trapezoidal crenellations adapted to a pulley of the poly-V type. ~~The A~~ cylindrical bore 6 is may be limited by a shoulder 25 formed at one axial end of the outer support 5 and in contact with the transverse surface 7d of the outer ~~rae~~groove 7. ~~The shaft is~~ may be replaced by a hub 26 ~~also having with~~ a shoulder 27 which may delimiting its outer cylindrical surface and allowing an axial positioning of the inner ~~rae~~groove 8 of the antifriction bearing 2. The hub 26 ~~has~~ may include a bore 28.

~~The embodiment illustrated in figure~~ FIG. 6 depicts an embodiment of a freewheel bearing device ~~is provided for~~ applications in which the torque to be transmitted is relatively weak. This embodiment is comparable to that in figure 4 ~~except that it has~~ A freewheel bearing device may not include an ~~no~~ outer spring. ~~The A~~ bore 6 of the outer support 5 ~~also may not include~~ has no a notch. ~~The In an embodiment, a freewheel 3 comprises for applications with low torque transmission may include a single spring, that is~~ A spring may include an the inner spring 19 whose free end 21 is interlocked in rotation with the shaft 4, and whose ~~e~~Coils of an inner spring 19 may contact or rub on the ~~a~~ bore 13b of the ~~an~~ axial extension 13 of the cage 10. In locking mode, the coils in radial extension are may be locked in the bore 13b of the ~~a~~ radial extension 13 and therefore interlock the ~~a~~ cage 10 with the ~~a~~ shaft 4. The rolling elements 9 are therefore may also be interlocked with the shaft 4, and the An outer raegroove 7 may be interlocked with the outer support 5 and may remains substantially stationary relative to the shaft 4, as long as ~~insofar as~~ the torque to be transmitted is not too great and the radial load of the antifriction bearing 2 is sufficient. This ~~is~~ may be a particularly economical embodiment.

~~The embodiment in figure~~ FIG. 7 depicts a freewheel bearing device with a ~~is also economical with a single spring, that is the~~ outer spring 20. A freewheel bearing device with a single outer spring may be economical. ~~As for the rest, this embodiment is similar to that of figure 4. As for the embodiment in figure 6, it is an economical variant fitted with a~~ A single

outer spring 20 ~~here placed~~ may be positioned between the ~~a~~ radial extension 13 of the cage 10 and the outer support 5.

~~The embodiment in figure FIG. 8 depicts an embodiment of a freewheel bearing is~~
5 ~~similar to the embodiment in figure FIG. 1 except that the spring has~~ may not include ~~no a~~
~~outer portion~~ second end with coils. The ~~s~~ Spring bearing reference number 29 comprises may
include an inner part ~~first end~~ 15 similar to ~~that~~ the embodiment of the spring depicted in
figure 1 and may include a radial portion 17 facing ~~that faces~~ outward and may interfere
~~interfering with the~~ an axial extension 13 of the cage 10. ~~More precisely, said~~ In an
10 embodiment, an axial extension 13 ~~is provided~~ may include ~~with~~ a notch 18 extending
radially outward from its bore over a portion of its radial height and disposed at its free axial
end opposite the rolling elements 9. ~~The~~ A radial portion 17 of the ~~a~~ spring 29 may protrude
~~into said the~~ notch 18 and interlocks in rotation, ~~the~~ A radial portion 17 may form ~~forming~~
one end of the spring 29 with the cage 10.

15 ~~In an embodiment, an economical embodiment of a freewheel bearing device may~~
include ~~This embodiment is therefore also economical with a single spring placed positioned~~
on a single side of the cage, such as ~~here on the~~ inside surface of the cage. In torque
transmission mode, ~~the~~ a inner portion ~~first end~~ 15 of the ~~a~~ spring 29 ~~is~~ may engaged with the
20 a shaft 4, ~~whereas in~~ In a disengaged mode, the coils of ~~the~~ the first end inner portion 15 are
~~in~~ may contact with ~~the~~ a shaft 4 with a slight friction. ~~The~~ A cage 10 may then turns freely
relative to the shaft 4.

~~FIG 9 depicts an embodiment of a freewheel bearing similar to~~ ~~The embodiment~~
25 ~~illustrated in figure 9 is similar to that in figure FIG. 1. The~~ A freewheel ~~comprises~~ may
include a single spring 30 placed positioned between the ~~an~~ axial extension 13 of the cage 10
and the outer support 5. ~~The~~ A spring 30 ~~comprises~~ may include coils which ~~forming an outer~~
~~portion~~ second end 16 similar to ~~that illustrated the embodiment depicted in figure FIG. 1,~~
~~and~~ A spring may include a radial portion 17 protruding into a notch 18 which ~~extending~~
30 radially inward from the outer cylindrical surface 13a of the axial extension 13 of the cage
10, and A radial portion may be formed at the ~~a~~ free axial end of ~~the~~ an axial extension 13
and opposite the rolling elements 9. The radial portion 17 ~~placed positioned~~ in the notch 18 is
may interlocked in rotation with the cage 10 while the coils forming the ~~outer portion~~ second
end 16 are may tightened in the cylindrical bore 6 of the outer support 5 and thus may

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~~providing~~ provide a transmission of torque, or, in the case of reversal of relative rotation, may rotate at the same angular speed as the cage 10 with a slight friction relative to said bore 6 of the outer support 5.

5 ~~_____~~ In the embodiment illustrated in ~~figure~~ FIG. 10, ~~the a~~ freewheel 3 is ~~may be~~ integrated
~~into in~~ the antifriction bearing 2. ~~More precisely~~ For example, the an ~~outer racegroove~~ 7
~~comprises~~ may include an axial extension 31 on the side of the freewheel 3 ~~which that~~
~~includes~~ has radial dimensions ~~identical~~ substantially similar to the rest of the outer
10 ~~racegroove~~ 7. ~~Likewise, the~~ The inner racegroove ~~8 comprises~~ may include an axial
prolongation 32, which has ~~the same a~~ a similar bore as the inner ~~racegroove~~ 8, and an outer
cylindrical surface of lesser ~~a~~ a smaller diameter, ~~for~~ For example, a diameter of an outer
cylindrical surface may substantially equal ~~to that of the diameter of~~ the bottom of the
antifriction bearing ~~racewaychannel~~ 8b. ~~The A~~ cage 10 comprises ~~may include~~ an axial
extension 33 with ~~the same~~ similar inner and/or outer diameters as the circular portion 12 and
15 as the portions 11 formed between the receptacles in which the rolling elements 9 are
~~disposed~~ positioned.

~~_____~~ A spring 29, ~~similar to that mounted in the embodiment illustrated in figure~~ FIG. 8 but
~~of with~~ smaller dimensions, may include ~~comprises an inner portion a first end~~ 15, provided
20 with a plurality of coils in contact with the outer cylindrical surface of the an axial
prolongation 32 of the inner racegroove 8, and a radial portion 17, which may protrude
~~protruding into the an~~ axial extension 33 of the cage 10; In an embodiment, a radial portion
17 may more precisely protruding protrude into a radial blind hole, which is not shown; A
radial blind hole may be formed from the bore of the axial extension 33 and facing outward,
25 or sunk into the material forming the axial extension 33. Thus, the a spring 29 may include
~~has one a~~ first end, that is the radial portion 17, interlocked in rotation with the cage 10 and
~~another a~~ second end formed by the coils of the ~~inner portion first end 15, and which is~~
~~capable of being either~~ A second end 16 may be interlocked in rotation with the inner
~~racegroove~~ 8 in torque transmission mode; ~~or of~~ A second end may move ~~ing~~ with a slight
30 friction relative to said the outer surface of the axial prolongation 32 of the inner ~~racegroove~~ 8
8 in freewheel mode, in which the outer racegroove 7 and the inner racegroove 8 move at
different angular speeds. This embodiment is ~~may be~~ extremely compact and/or may
combines the functions of rolling bearing and freewheel.

~~In some embodiments. Generally, it is also conceivable to furnish an embodiment of the device illustrated in figure FIG. 1 may include with two springs such as the springs 28 and 29 of the embodiments in figures FIGS. 8 and 9, rather than thus replacing the spring 14. The embodiment of the device illustrated in figure FIG. 10 could perfectly well may be~~
5 ~~equipped with springs of the types similar to the springs illustrated in the other embodiments, such as notably the spring 14 depicted in figure FIG. 1 or be furnished with two springs 29, and 30 depicted in FIGS. 8 and 9.~~

~~Generally, d~~During freewheel operation, the friction between the coils of the a spring and the corresponding friction bearing surface ~~is~~ may be generated at a reduced relative speed arising directly from the differential angular speed between the a cage of the an antifriction bearing and the a racegroove of the antifriction bearing to which the friction bearing surface is ~~connected~~ coupled. Wear of the spring by friction is ~~therefore~~ may be substantially ~~considerably~~ reduced since the antifriction bearing cage may rotates at an angular speed equal
10 to approximately half the difference between of the angular speeds of the racegrooves. If N is the differential angular speed between the an outer racegroove and the an inner racegroove of the an antifriction bearing in freewheel operation, the differential angular speed between the spring and its friction bearing surface will may be substantially equal to N/2 according, to the ~~invention in an embodiment,~~ instead of N in the case of the such as in the prior art. Evidently
15 the A result is may be an appreciable increase in the lifetime of the system according to the invention.

~~In this patent, certain U.S. patents, U.S. patent applications, and other materials (e.g., articles) have been incorporated by reference. The text of such U.S. patents, U.S. patent~~
25 ~~applications, and other materials is, however, only incorporated by reference to the extent that no conflict exists between such text and the other statements and drawings set forth herein. In the event of such conflict, then any such conflicting text in such incorporated by reference U.S. patents, U.S. patent applications, and other materials is specifically not incorporated by reference in this patent.~~

~~Further modifications and alternative embodiments of various aspects of the invention will be apparent to those skilled in the art in view of this description. Accordingly, this description is to be construed as illustrative only and is for the purpose of teaching those skilled in the art the general manner of carrying out the invention. It is to be understood that~~

5 | the forms of the invention shown and described herein are to be taken as the presently preferred embodiments. Elements and materials may be substituted for those illustrated and described herein, parts and processes may be reversed, and certain features of the invention may be utilized independently, all as would be apparent to one skilled in the art after having the benefit of this description of the invention. Changes may be made in the elements described herein without departing from the spirit and scope of the invention as described in the following claims.

ABSTRACT

5 ~~The inventive device of a~~ A free wheeling bearing (1) comprises ~~may include~~ a rolling bearing and a freewheel. A rolling bearing may include (2) provided with a plurality of
10 rolling elements (9); and a cage (10) which may for retaining said the rolling elements (9) and
 a A free wheel (3) provided with may include a spring (14). Said A spring (14) comprises
 may include a first end, a second end, and a radial central portion. a first part (17) A radial
 central portion may interacting with the a cage (10) and a Ends of the spring second part
10 (15) thereof may interacting with an external outer or an internal inner element (e.g., an outer
 support or a shaft). which is Elements may be directly or indirectly connected coupled to a
 body on which the rolling elements run.